

REMARKS

The rejection of Claims 1-23 on the ground of non-statutory obviousness-type double patenting over Claims 1-30 of US 7,271,299 (Hesse et al '299) in view of US 6,248,906 (Bertola)¹, is respectfully traversed.

An embodiment of the present invention, as recited in Claim 1, is a process for variably preparing mixtures of optionally alkyl-substituted butanediol (BDO), butyrolactone (GBL) and tetrahydrofuran (THF) by two-stage hydrogenation in the gas phase of C₄ dicarboxylic acids and/or derivatives thereof, which comprises

a) hydrogenating in a gas phase a gas stream of C₄ dicarboxylic acids and/or derivatives thereof over a catalyst at a pressure of from 2 to 100 bar and a temperature of from 200°C to 300°C in a first reactor in the presence of a noble metal-free catalyst in the form of shaped catalyst bodies having a volume of less than 20 mm³, said catalyst from 5 to 95% by weight of oxide of copper and from 5 to 95% by weight of an oxide having acidic sites, to give a stream containing alkyl-substituted GBL and THF,

b) removing any succinic anhydride (SA) formed by partial condensation,
c) converting the products remaining predominantly in the gas phase in the partial condensation, THF, water and GBL, under the same pressure or under a pressure reduced by the pressure drops in the hydrogenation circuit and at a temperature of from 150 to 240°C, in a second reactor over a noble metal-free catalyst which ≤ 95% by weight of CuO and from 5 to 95% by weight of one or more oxides selected from the group of ZnO, Al₂O₃, SiO₂, TiO₂,

¹ That the new prior art, i.e., Bertola, is not listed in the statement of the rejection is irrelevant; reliance thereon is all that is necessary. “Where a reference is relied on to support a rejection, whether or not in a ‘minor capacity,’ there would appear to be no excuse for not positively including the reference in the statement of rejection.” *In re Hoch*, 428 F.2d 1341, 166 USPQ 406, 407 n.3 (CCPA 1970). See also MPEP 706.02(j).

ZrO₂, CeO₂, MgO, CaO, SrO, BaO, La₂O₃ and Mn₂O₃ to give a stream comprising a mixture of BDO, GBL and THF,

d) removing the hydrogen from the products and recycling it into the hydrogenation,
e) separating by distillation the products, THF, BDO, GBL and water, recycling a GBL-rich stream into the second reactor or discharging it, and working up BDO, THF and GBL by distillation,

and setting the ratio of the products, THF, GBL and BDO, relative to one another within the range from 10 to 100% by weight of THF, from 0 to 90% by weight of GBL and from 0 to 90% by weight of BDO only by varying the temperatures in the two hydrogenation reactors and also the GBL recycle stream.

(Emphasis added.)

As previously argued, the claims of Hesse et al '299 neither disclose nor suggest the limitation of the present claims emphasized above.

In the Office Action, the Examiner refers to various disclosures in Hesse et al '299, and cites column 10, lines 47-62 [sic] as disclosing “that the ratio of THF, GBL, and BDO is a function of various temperatures.”

In reply, in an obviousness-type double patenting rejection, the specification of the patent or application relied on as the subject of double patenting may be relied on only for limited purposes, such as to define the meaning of a term in a claim. The specification may not be relied on for prior art purposes. The issue is whether the presently-claimed invention would have been obvious over the **claims of Hesse et al '299**. Hesse et al '299 at column 10, lines 47-62 [sic, lines 48-61] discloses that the temperature increase in the gas stream in the reactor should not exceed a particular temperature, and that large temperature increases lead to overhydrogenation reactions and (BDO+GBL) selectivity loss; that a particular pressure range is selected for the first hydrogenation stage, whereby hydrogenation of MA proceeds

with very substantial suppression of THF formation from the initially formed intermediate GBL; and in the second hydrogenation stage a particular pressure range is chosen. This disclosure, even if legally entitled to be relied upon, does not suggest the presently claimed invention.

The Examiner relies on Bertola for a disclosure that “[p]ressure and temperature in the primary hydrogenation, as well as residence times on the catalysts can be optimized depending on the proportions between the GBL and THF to be produced” (column 2, lines 42-45). The Examiner then cites case precedent for the proposition that where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.

In reply, the presently-claimed invention is **not** the result of optimization of anything, but rather, is based on Applicants' discovery that when the claimed process is carried out, as shown in above-recited steps a) through e), differing amounts of BDO, GBL and THF can be obtained without altering the plant or the catalyst by varying **only** the temperatures in the two hydrogenation zones and also the GBL recycle stream, as emphasized above and as described in the specification at paragraph [0014].

Thus, while Bertola discloses a process for the production of BDO, GBL and THF by a two-stage hydrogenation starting from maleic anhydride esters, Bertola neither discloses nor suggests the above-emphasized limitation of Claim 1. One of ordinary skill in the art would not appreciate from Bertola that adjusting temperature as the only variable would permit control of the relative amounts of THF, GBL and BDO.

For all the above reasons, it is respectfully requested that this rejection be withdrawn.

The rejection of Claims 1-23 on the ground of non-statutory obviousness-type double patenting over Claims 1-30 of US 7,154,011 (Hesse et al '011) in view of Bertola, is respectfully traversed.

Sole independent Claim 1 of Hesse et al '011 reads as follows:

A process for preparing optionally alkyl-substituted 1,4-butanediol by two-stage catalytic hydrogenation in the gas phase of C₄-dicarboxylic acids and/or of derivatives thereof having the following steps:

- a) introducing a gas stream of a C₄-dicarboxylic acid or of a derivative thereof at from 200 to 300°C and from 10 to 100 bar into a first reactor or into a first reaction zone of a reactor and catalytically hydrogenating it in the gas phase to a product which contains mainly optionally alkyl-substituted γ -butyrolactone;
- b) introducing the product stream obtained in this way into a second reactor or into a second reaction zone of a reactor at a temperature of from 140°C to 260°C and catalytically hydrogenating it in the gas phase to optionally alkyl-substituted 1,4-butanediol;

steps a) and b) being carried out at the same pressure;

- c) removing the desired product from intermediates, by-products and any unconverted reactant;
- d) optionally recycling unconverted intermediates into one or both hydrogenation states,

said hydrogenation stages each using a catalyst which comprises \leq 95% by weight of CuO, and \geq 5%, of an oxidic support, and the product mixture removed from the first hydrogenation stage being introduced without further purification into the second hydrogenation stage.

While there may be some similarities between the claimed invention of Hesse et al '011 and presently-recited steps a) through e) of present Claim 1, the claims of Hesse et al '011 disclose and suggest nothing with regard to the above-emphasized limitation of present Claim 1. Again, like in the rejection over Hesse et al '299, the Examiner improperly relies on the specification of Hesse et al '011. Indeed, at least one of the rationales of the present rejection, i.e., that it is not inventive to discover optimum or workable ranges by routine experimentation, has been responded to above, in traversing the rejection involving Hesse et al '299. In addition, the Examiner further finds that there is no apparent reason why Applicants were prevented from presenting claims corresponding to those of the present

application during prosecution of the application which matured into Hesse et al '011, relying on *In re Schneller*, 397 F.2d 350, 158 USPQ 210 (CCPA 1968) and M.P.E.P. § 804.

In reply, the presently-claimed invention was **not** described in the disclosure of Hesse et al '011, and particularly the above-emphasized limitation thereof and therefore, could not be claimed therein. Neither the disclosure relied on by the Examiner at column 9, lines 46-47, which discloses that an important parameter is the maintenance of a suitable reaction temperature in both hydrogenation steps, or column 10, lines 39-43, which discloses that the temperature increase in the gas stream in the reactor should not exceed a particular temperature, and that large temperature increases lead to overhydrogenation reactions and (BDO+GBL) selectivity loss (like in Hesse et al '299), or any other disclosure therein, forms a basis for the above-emphasized limitation of Claim 1.

For all the above reasons, it is respectfully requested that this rejection be withdrawn.

Applicants respectfully submit that all of the presently-pending claims in this application are in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to pass this application to issue.

Respectfully submitted,

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